ZTR

Control Systems

What you have always wanted to know about idling locomotives……..

……..But were afraid to ask.

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What I hope to leave you with today is……

- ***An understanding of some of the complexities involved with shutting down and restarting locomotives.***
- ***How technology has helped to automate the performance of this task and turn it into a win-win situation on older locomotives.***
- ***An example of idle reduction impact***

Let’s start with some common ground…….

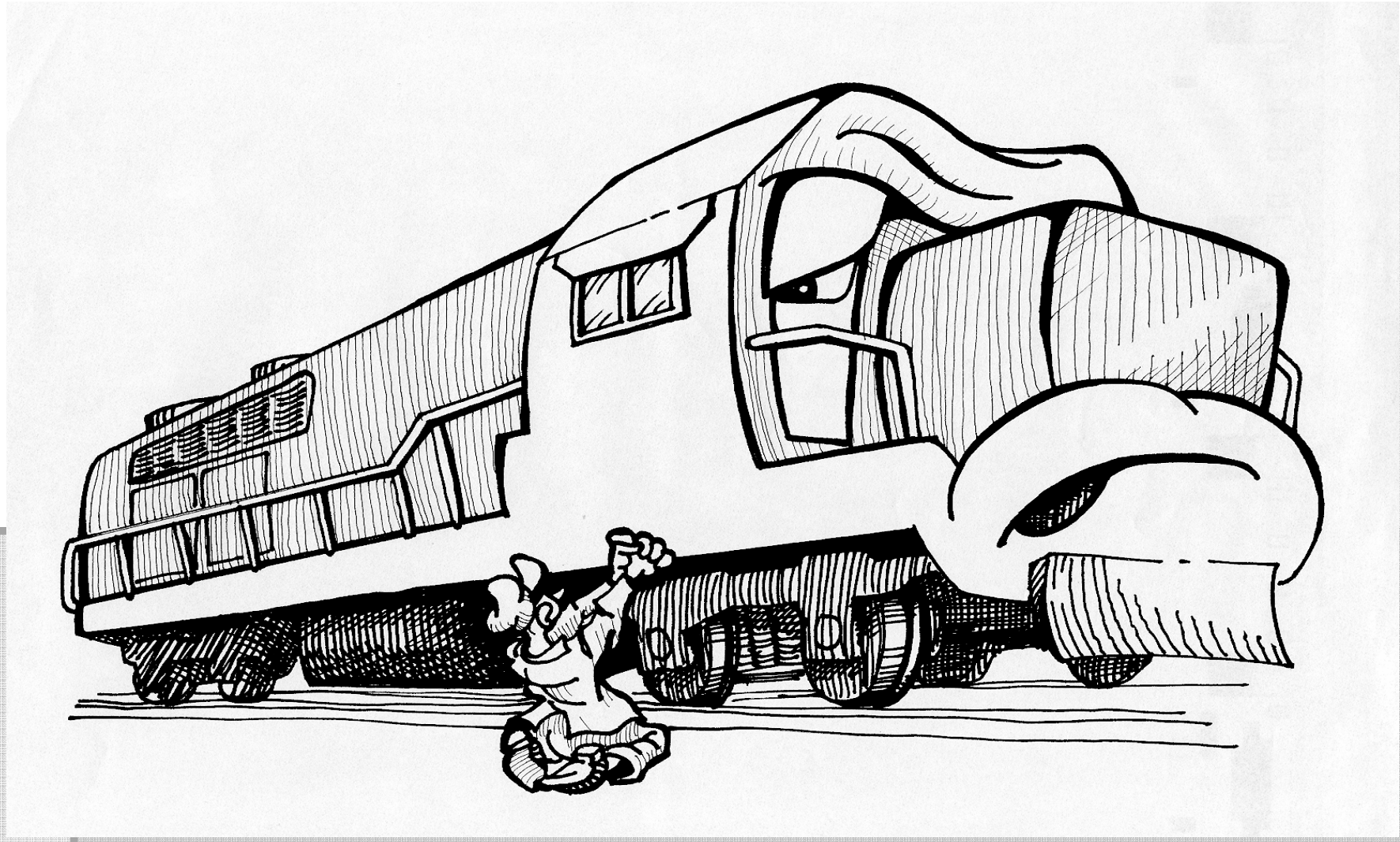
- Shutting down locomotives, when they are not being utilized, reduces fuel burned which reduces emissions.

Now if we are all in agreement with this, then why are we here?

The answer is……

- Shutting them down is not the problem!

The problem lies in …..what happens <u>after</u> you shut them down….or try to get them to restart.



Some detrimental incidents that can arise while locomotives are shut down include……

- Batteries discharging
- Coolant leaking into a cylinder
- Engine becoming “Cold Soaked”
- Outside temperature dropping below freezing
- The Dump Valve dumping the coolant

<u>Manually</u> restarting a locomotive engine, can in itself be a challenge…….

- **Some locomotives are 30 to 40 years old**
- **Dealing with a variety of different engines**
- **Horsepower ranges from 1000 to 3000+**
- **Differences in starting systems**
- **Unknown condition of batteries**

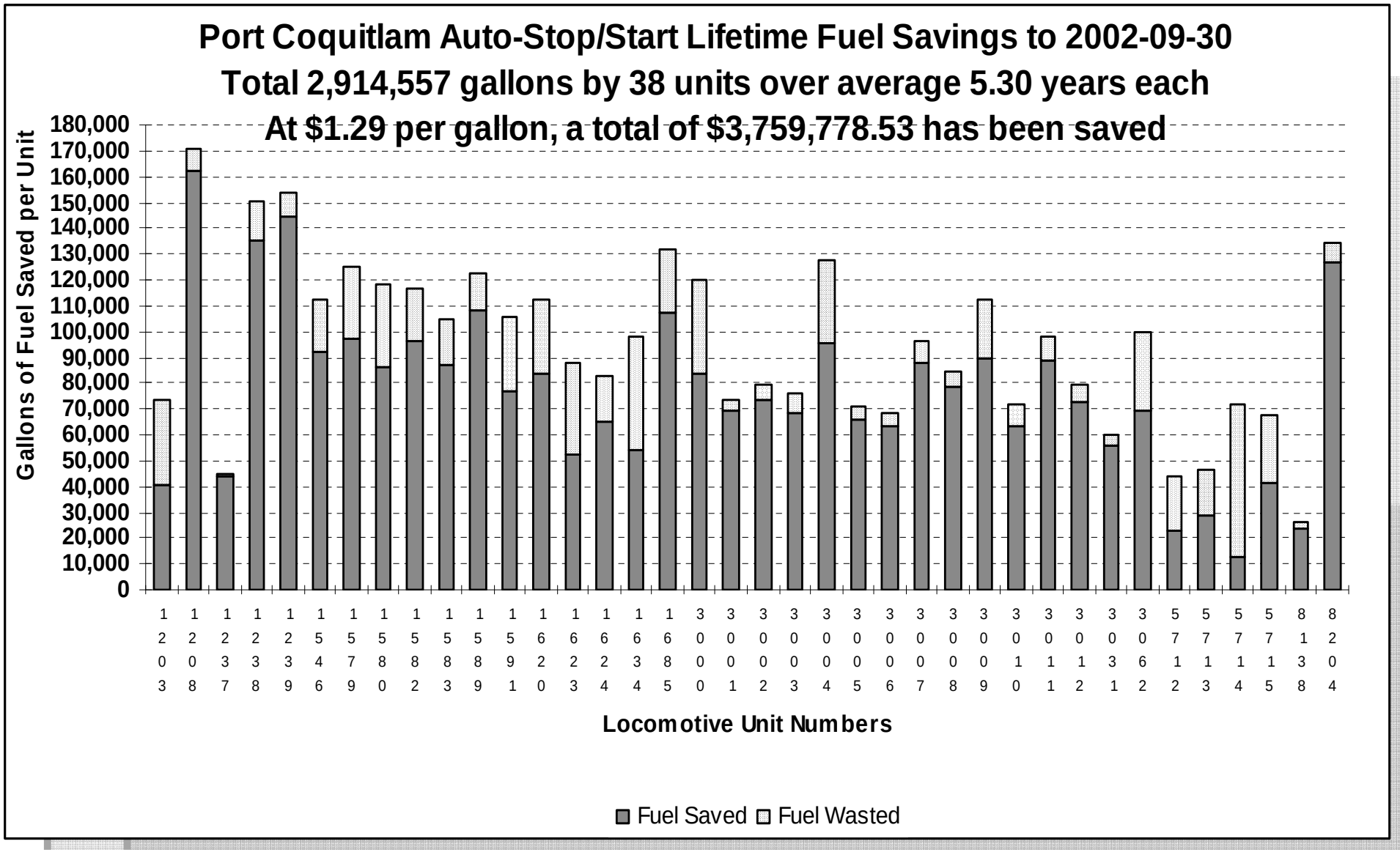
Successfully automating the process was complex and required a microprocessor based product like……

SmartStart

SmartStart was designed to meet stringent objectives…… Included among these was the need to…….

- Determine if the locomotive should or could be shut down.
- Protect the locomotive while it was shut down.
- Be able to reliably restart it.
- Perform all of these tasks safely.
- Be durable enough to live in this environment
- Report on how well the system performed its job.
- Provide the user with information not just data.

So how has SmartStart been doing?



SmartStart has saved our users millions of gallons and we're still counting…..

- **Actual Fuel Savings on *SmartStart* equipped locomotives operating on a Canadian Class 1 railroad:**

  (Does not include any savings from their active manual shutdown policy)

  - **Number of locomotives tracked** **38**
  - **Average period per locomotive** **5.3 years**
  - **Total fuel saved** **2,914,557 gallons**
  - **Average fuel saved per locomotive** **76,699 gallons**
  - **Average fuel saved per locomotive per year** **14,471 gallons**

- ***And….think of the reduction in emissions!***

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<u>2,914,557 Gallons Saved</u>

4 Gallons Per Hour at Idle = 728,639 Hrs. of Reduced Idle Time

A two cycle engine produces 800 Grams of NOx per hour at Idle

728,639 Hours of Reduced Idle X 800 Grams = 582,911,200 Grams of NOx

582,911,200 Grams/454grams per lb. = 1,283,945 lbs./2000 lbs. per ton =

642 Tons of NOx or 17 Tons Per Locomotive

17 Tons/5.30 Years = 3.2 Tons per Locomotive Per Year

How do we compile these statistics?

SmartStart Detail Report

Rail Road:
Road Number: 1682
Location: OpCenter Demo

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Reporting Period

	Installation	Previous Report	Current Report		Since Installation	Previous Report
Date:	12/2/1993	12/6/2003	1/3/2004	**Days:**	3683.9	28.0
Time:	16:24:06	13:15:50	13:17:46	**Hours:**	88412.9	672.0

Locomotive Operating Statistics (Hours)

	Since Installation		Since Previous Report	
In Service Hours:	74674.1	= 3111.4 Days	672.0	= 28.0 Days
Out of Service Hours:	13738.8	= 572.4 Days	0.0	= 0.0 Days

	Since Installation	Since Prev. Report		Since Installation	Since Previous Report
ENGINE SHUTDOWN:	32604.1	273.5	**IDLING:**	34585.6	389.8
Manual:	2862.4	0.0	**Working Idle:**	14692.5	56.7
SmartStart:	29741.7	273.6	**Parked Idle:**	19893.1	333.1
ENGINE RUN:	42070.0	398.5	**PARKED IDLE:**	19893.1	333.1
Loading:	7484.4	8.7	**Unavoidable Idle:**	11382.9	298.4
Idling:	34585.6	389.8	**Manageable Idle:**	8510.2	34.7

Unsatisfied Parameters Preventing Shutdown (Hours)

		UNAVOIDABLE			
Ambient Temp:	12207.8	298.5	**Water Temp:**	50.0	0.0
		0.0	**High Water Temp:**	0.0	0.0
		MANAGEABLE			
Brake Pressure:	2432.7	11.8	**Battery Voltage:**	0.0	0.0
Battery Charging:	1656.2	22.9	**Extended Idle:**	26.9	0.0
Reverser not Centered:	506.5	0.0	**SS Switch Off:**	4248.4	0.0

Reason(s) for Restart After SmartStart Shutdown (Counts) Shutdown (Counts)

Brake Pressure:	12090	78	**Ambient Temp:**	101	4
Water Temp:	4245	33	**Battery Voltage:**	1086	30
Reverser:	5587	6			
SmartStart Restarts:	23109	151	**Other Restarts:**	844	42

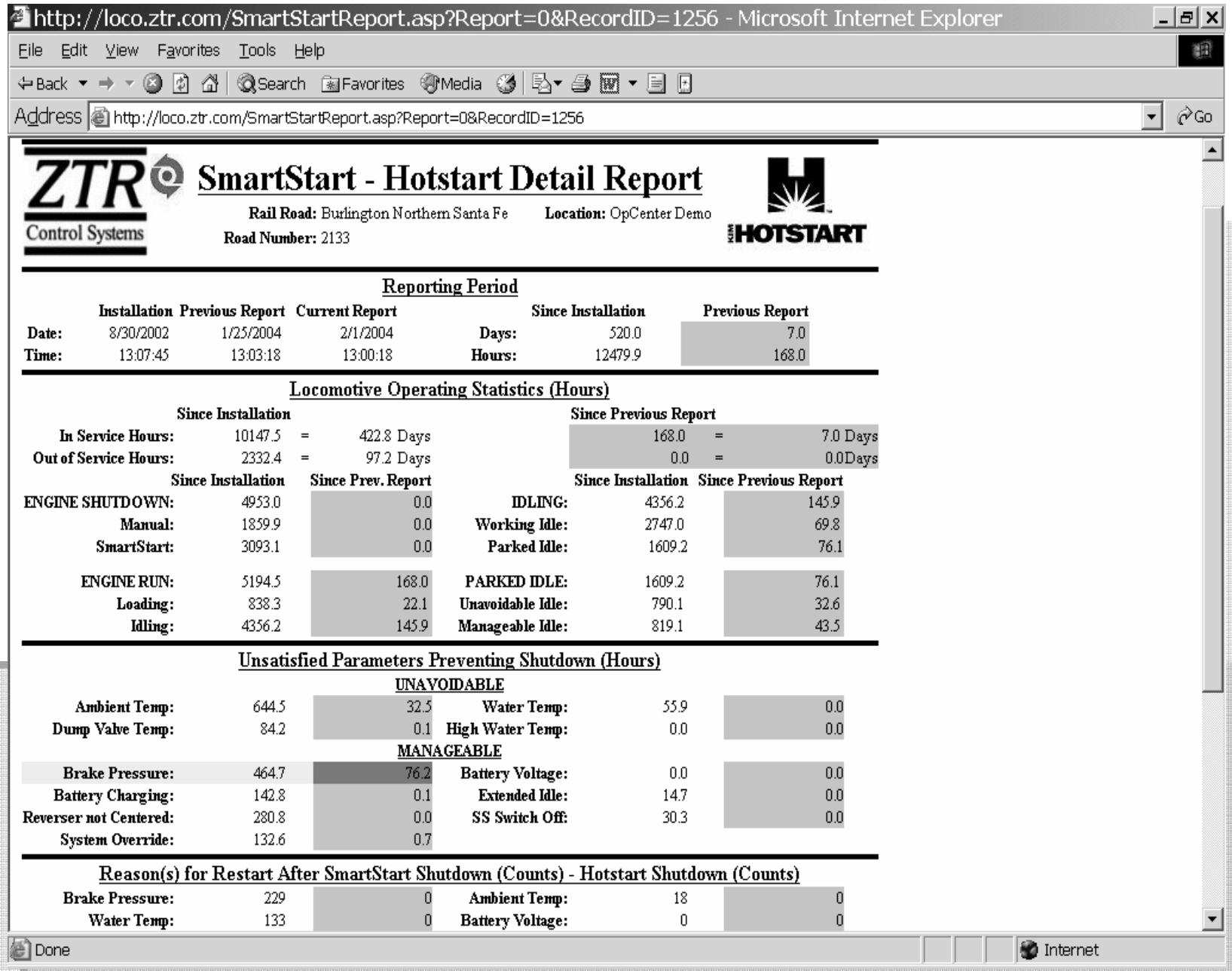
SmartStart Shutdown Information

Count:	23953	193	**Time:**	29741.70	273.60

SmartStart Savings Analysis

Savings Realized By SmartStart :	$ 153467.17	$ 1411.78
Additional Potential Savings NOT Realized By SmartStart:	$ 29641.03	$ 120.86
(Based on 67.5 % of Manageable Idle Hours)		

NOTE: Figures based on locomotive fuel consumption rate of 4.0 gallons/hr at $ 1.29/gallon.
135 / 22 / 11400 / 22833 / 58 / -40 / -40 / -40


http://loco.ztr.com/SmartStartReport.asp?Report=0&RecordID=1256 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://loco.ztr.com/SmartStartReport.asp?Report=0&RecordID=1256
Go
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SmartStart - Hotstart Detail Report
Rail Road: Burlington Northern Santa Fe
Location: OpCenter Demo
Road Number: 2133
HOTSTART
Reporting Period
Installation Previous Report Current Report Since Installation Previous Report
Date: 8/30/2002 1/25/2004 2/1/2004 Days: 520.0 7.0
Time: 13:07:45 13:03:18 13:00:18 Hours: 12479.9 168.0
Locomotive Operating Statistics (Hours)
Since Installation Since Previous Report
In Service Hours: 10147.5 = 422.8 Days 168.0 = 7.0 Days
Out of Service Hours: 2332.4 = 97.2 Days 0.0 = 0.0Days
Since Installation Since Prev. Report Since Installation Since Previous Report
ENGINE SHUTDOWN: 4953.0 0.0 IDLING: 4356.2 145.9
Manual: 1859.9 0.0 Working Idle: 2747.0 69.8
SmartStart: 3093.1 0.0 Parked Idle: 1609.2 76.1
ENGINE RUN: 5194.5 168.0 PARKED IDLE: 1609.2 76.1
Loading: 838.3 22.1 Unavoidable Idle: 790.1 32.6
Idling: 4356.2 145.9 Manageable Idle: 819.1 43.5
Unsatisfied Parameters Preventing Shutdown (Hours)
UNAVOIDABLE
Ambient Temp: 644.5 32.5 Water Temp: 55.9 0.0
Dump Valve Temp: 84.2 0.1 High Water Temp: 0.0 0.0
MANAGEABLE
Brake Pressure: 464.7 76.2 Battery Voltage: 0.0 0.0
Battery Charging: 142.8 0.1 Extended Idle: 14.7 0.0
Reverser not Centered: 280.8 0.0 SS Switch Off: 30.3 0.0
System Override: 132.6 0.7
Reason(s) for Restart After SmartStart Shutdown (Counts) - Hotstart Shutdown (Counts)
Brake Pressure: 229 0 Ambient Temp: 18 0
Water Temp: 133 0 Battery Voltage: 0 0
Done
Internet

In closing, I would like to say that ZTR Control Systems has been in the business of making the reduction of emissions a win-win situation for locomotive owners and the environmental community, for over 15 years. We plan to stay the course and to offer solutions that will continue this tradition. Let us know how we can help.

Thank You